O-2012

OPERATE THE GLOBAL POSITIONING SYSTEM

CONDITIONS

You are an Observer trainee and must use the GPS for navigation and position determination.

OBJECTIVES

Demonstrate how to use the GPS for navigation and position determination.

TRAINING AND EVALUATION

Training Outline

1. As a Mission Observer trainee, knowing how to use the GPS and its limitations is essential. The Global Positioning System (GPS) allows the aircraft to be flown to a desired location, such as a search pattern entry point, with precision and economy. Once in the search or assessment area, the GPS allows the pilot to fly the assigned area precisely and thoroughly. From the mission staff's viewpoint, proper use of the GPS assures them that the assigned area was actually flown -- the only variables left to accommodate are search effectiveness and the inherent limitations of scanning.

One drawback is that setting up and manipulating the GPS may distract the pilot (and observer) from looking outside of the aircraft. The great majority of CAP missions are performed in VFR conditions, and the CAP aircrew must not forget the importance of looking where you're going. The best way to avoid this trap is to become and continue to be very familiar with the operation of the GPS. Training and practice (along with checklists or aids) allows each crewmember to set or adjust instruments with minimum fuss and bother, thus allowing them to return their gaze outside the aircraft where it belongs. All members of the aircrew should be continuously aware of this trap.

Additionally, it is important that observers use this equipment to help the pilot maintain situational awareness. *The observer should always know the aircraft's position on the sectional chart*, and the GPS enables him or her to do so with great accuracy.

2. The Global Positioning System relies on a chain of 24 satellite transmitters in polar orbits about the earth. The speed and direction of each satellite, as well as each satellite's altitude is precisely maintained so that each satellite remains in a highly accurate and predictable path over the earth's surface at all times. The GPS receiver in the aircraft processes signals transmitted by these satellites and triangulates the receiver's position, which the user again can read directly in latitude and longitude coordinates from a digital display. The system is substantially more accurate than LORAN, VOR, DME, or ADF and has several advantages.

Because the transmitters are satellite (not ground) based, and the signals are essentially transmitted *downward*, system accuracy is not significantly degraded in mountainous terrain. Additionally, the system is not normally vulnerable to interference from weather or electrical storms. Receivers can typically process as many as twelve received signals simultaneously, and can automatically deselect any satellite whose signal doesn't meet specific reception parameters. The system can function with reasonable accuracy using as few as three received signals.

3. To a new operator, the GPS is complex and can initially increase the user's workload. Pilots and observers *must read the operating manual or instructions* and become thoroughly familiar with GPS operation before flight, so that operating the GPS *will not become a distraction* from more important tasks. Also, many manufacturers have CD simulators (e.g., U.S. Aviation Technologies' Apollo GX55; www.upsat.com) that allow individuals to practice use of the GPS on a computer.

4. CAP is standardizing the fleet with the Apollo GX55 (below). Even if your aircraft has a different GPS, the basic functions are the same.

All GPS units display bearing and distance to waypoints (i.e., airports, VORs, intersections, and user waypoints); position can also be determined by displaying current lat/long coordinates. For emergency use, all GPS units have a feature that allows you quickly and easily display bearing and distance to the nearest airports or VORs (often a list of the ten nearest facilities).

The GPS displays altitude, ground speed, estimated time to the waypoint (ETE), and ground track. GPS databases also contain extensive information about selected waypoints (e.g., an airport) such as runway length and alignment, lighting, approaches, frequencies, and even FBO details such as the availability of 100LL fuel and hours of operation.

The GPS receiver also allows pilots to:

<u>Fly directly to any position</u>
The ability to fly directly to any position (e.g., an airport, navaid, intersection, or user waypoint) saves time and fuel. This reduces transit time, thus allowing more of the crew's allowed duty day to be spent in the search area. Any of these positions can be entered as the destination through a simple procedure. Additionally, all GPS have a "Nearest Airport" and "Nearest VOR" function, where you can easily display a list of the nearest airports or VORs and then select it as your destination. Positions can also be grouped into flight plans.
Once the destination is entered into the GPS, the heading and the ground track can be monitored. *By matching the heading and ground track (or keeping the CDI centered), you are automatically compensating for wind and thus flying the shortest possible route to your destination*.

<u>Fly between any two points</u>
The ability to fly directly between any two points greatly improves search effectiveness. These points, usually defined by latitude and longitude (lat/long), can be flown in either of two ways:

a. The points can be entered into the GPS as user-defined waypoints. The waypoints can then be recalled in the same manner as you would display an airport or navaid, or they can be entered into a flight plan.
b. The pilot can fly between the points by observing the current lat/long display (i.e., a real-time readout of latitude and longitude).

5. Two factors have reduced search effectiveness in the past: drifting off course due to shifts in wind direction, and drifting off course because of the lack of adequate boundaries (e.g., cross-radials or visible landmarks). Now any search pattern can be flown precisely without relying on cross-radials or ground references. The crew and the mission staff know that a route or area has been covered thoroughly. Also, GPS allows the crew to remain within assigned boundaries, which greatly improves safety when more than one aircraft is in the search area at the same time.

NOTE: The Apollo GX55 has a "moving map," which greatly enhances situational awareness. It shows aeronautical and ground features in (scalable) detail, and also displays special use airspace. Another feature, added to the unit for CAP use, is the SAR MAP mode. This feature allows you to select, define and fly directly to a CAP grid, and to superimpose a search pattern on the grid (e.g., parallel, creeping line or expanding square). The SAR features will be covered in another task guide.

Additional Information

The VOR/DME is covered in task O-2011, and may be performed concurrently with this task. More detailed information on this topic and examples are available in Chapter 8 and Attachment 2 of the MART.

Evaluation Preparation

Setup: Provide the student access to an aircraft or a GPS simulator.

Brief Student: You are an Observer trainee asked to determine aircraft position with the GPS.

Evaluation

Performance measures	Results	
1. Using the operator's manual, discuss the operation of the GPS.	P	F
2. Using the operator's manual, display information provided by the GPS:		
a. Altitude.	P	F
b. Ground speed.	P	F
c. Heading to waypoint and current heading.	P	F
d. Track over ground (ground track).	P	F
e. Estimated time to the waypoint (ETE).	P	F
3. Using the operator's manual, determine current position using:		
a. Bearing and distance to waypoints.	P	F
b. Present position (lat/long coordinates).	P	F
c. Moving map display (if applicable).	P	F
4. Using the operator's manual, enter a destination waypoint:		
a. Airport.	P	F
b. VOR.	P	F
c. User-defined (lat/long coordinates).	P	F
5. Using the operator's manual, display "nearest airport" and "nearest VOR."	P	F

Student must receive a pass on all performance measures to qualify in this task. If the individual fails any measure, show what was done wrong and how to do it correctly.

O-2013
<u>PLOT A ROUTE ON A SECTIONAL CHART</u>

CONDITIONS

You are an Observer trainee and must plot a simple route on a sectional chart.

OBJECTIVES

Plot a course on a sectional chart, select checkpoints along a route, and calculate how long it will take to fly the route.

TRAINING AND EVALUATION

Training Outline

1. As a Mission Observer trainee, knowing how to plot a route on a sectional chart is essential in order to assist the pilot, and help maintain situational awareness.

2. Plot the course. To determine a heading, locate the departure and destination points on the chart and lay the edge of a special protractor, or *plotter*, along a line connecting the two points. Use a marker to trace the route. Read the true course for this leg by sliding the plotter left or right until the center point, or grommet, sits on top of a line of longitude. When the course is more to the north or south, you can measure it by centering the grommet on a parallel of latitude, then reading the course from the inner scale that's closer to the grommet.

3. Distance. To determine the distance you're going to travel, lay the plotter on the route and read the distance using the scale that's printed on the plotter's straight edge: one edge measures nautical miles and the other statute miles.

4. Flight time. To determine the time it will take to fly between any two points, divide the distance (in nm) by the proposed airspeed (in knots).

5. Checkpoints. There are a number of ways you can add information to your chart that will help during the flight. Tick marks along the course line at specific intervals will help you keep track of your position during flight (situational awareness). Some individuals prefer five- or ten-nautical mile (nm) intervals for tick marks, while others prefer two- or four-nm intervals. Four-nautical mile spacing works well for aircraft that operate at approximately 120 knots. Since the 120-knot airplane travels 2 nm every minute, each 4 nm tick mark represents approximately two minutes of flight time. On the left side of the course line you have more tick marks, at five-nm intervals, but measured backward from the destination. In flight, these continuously indicate distance remaining to the destination, and you can easily translate that into the time left to your destination.

The next step in preparing the chart is to identify *checkpoints* along the course; you can use these to check your position on- or off-course, and the timing along the leg. Prominent features that will be easily seen from the air make the best checkpoints, and many like to circle them or highlight them with a marker in advance. You should select easy (large) targets such as tall towers, cities and towns, major roads and railroads, and significant topological features such as lakes and rivers. Try not to select checkpoints that are too close together. During a mission, checkpoint spacing will be controlled by the search altitude and weather conditions and visibility at the time of the flight.

Additional Information

More detailed information on this topic is available in Chapter 8 of the MART.

Evaluation Preparation

Setup: Provide the student with a sectional chart and a plotter. Give the student two points on the chart.

Brief Student: You are an Observer trainee asked to plot a course, select checkpoints along the route, and calculate time in flight.

Evaluation

Performance measures	Results	
Given a sectional chart, a plotter, and two points on the chart (e.g., two airports):		
1. Plot a course between the two points.	P	F
2. Select checkpoints along the route. Discuss the reason you selected the checkpoints.	P	F
3. Calculate the time it will take an aircraft (120 knots with no wind) to fly the route.	P	F

Student must receive a pass on all performance measures to qualify in this task. If the individual fails any measure, show what was done wrong and how to do it correctly.